

DRAWINGS ATTACHED

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(54) STUD-AND-SOCKET FASTENERS

(71) We, GKN SCREWS & FASTENERS LIMITED, a British Company of P.O. Box 61, Heath Street, Smethwick, Warley, in the County of Worcester, do hereby declare the invention for which we pray that a patent may be granted to us and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to stud-and-socket fasteners.

In our Complete Specifications Nos. 1,136,662 and 1,136,897 we have described a stud-and-socket fastener made of synthetic resinous material and comprising a turnpiece having a fastening projection at one end, a retaining piece arranged to be snapped into position on a first sheet and to receive the turnpiece to hold the latter to the first sheet, and a cam piece arranged to be snapped into position on a second sheet, the turnpiece being capable of being engaged with the cam piece and then turned to hold the first and second sheets together.

This fastener is useful where two sheets of comparatively thin sheet metal are to be connected together. In some cases, however, one of the sheets or members to be connected together is comparatively thick and is itself made of synthetic resinous material. Under these circumstances it is possible to dispense with at least a separate retaining piece and to mount the turnpiece directly in said one member, the other sheet or member having a cam piece snapped into position therein as described in said complete specifications or being formed integrally with the sheet.

The object of one aspect of the invention is to provide a turnpiece which may be used in the situation described above.

According to this aspect of the invention we provide a turnpiece made of synthetic resinous material for a stud-and-socket fastener and comprising a shank, a head at one end of the shank and a fastening projection extending outwardly from the shank adjacent the other end thereof, at least part of the shank between the head and the fastening projection having

a cross-section which is generally rectangular and presenting a pair of diagonally opposed sharp corners and a pair of diagonally opposed rounded corners. Normally the cross-sectional shape of said shank part will be substantially square.

If the turnpiece is mounted in a slot in said one member and which has a width which is greater than the maximum perpendicular distance between opposite sides of said part but less than the diagonal distance between said opposed sharp corners, the turnpiece can be turned through 90° to move each sharp corner from being in contact with one side of the slot to being in contact with the other side of the slot such turning not being prevented by the rounded corners which slide relative to the slot sides. Further turning movement is prevented, however, due to the width dimension of the slot and the cross-sectional shape of said shank part i.e. the engagement of the sharp corners with the sides of the slot. The movement of the turnpiece is thus limited to 90° which is what is desired for its engagement with a cam piece of the fastener as will be described below.

The head may include a thin skirt or flange adapted to act as spring means when the turnpiece is in use. As will be described the skirt or flange is deformed as the turnpiece is entered into the cam piece and forces the fastening projection into a detent in the cam piece when the projection is in alignment with said detent.

The skirt may be provided with a pair of diametrically opposed lugs which project from the skirt parallel to the shank and towards the fastening projection. These lugs may be arranged to co-act with abutments on the first member to assist in limiting movement of the turnpiece to 90°.

In a preferred construction the turnpiece, including the skirt and lugs where provided, is formed from a single piece of synthetic resinous material.

According to a second aspect of the invention we provide the combination of a turnpiece

for a stud-and-socket fastener, for holding together first and second apertured members in face-to-face relation, and a first such member, the turnpiece and the first member both being made of synthetic resinous material. the turn-
 5 piece comprising a shank, a head at one end of the shank and a fastening projection extending outwardly from the shank adjacent the other end thereof, at least part of the shank
 10 between the head and the fastening projection having a cross-section which is generally rectangular and presents a pair of diagonally opposed sharp corners and a pair of diagonally
 15 opposed rounded corners, said first member having a slot therein with a pair of parallel, straight sides spaced apart by a distance greater than the maximum perpendicular distance between opposite sides of said shank part
 20 of generally rectangular cross-section but less than the distance between said diagonally opposed sharp corners.

This combination has the advantage set forth above that rotation of the turnpiece is limited to 90° by virtue of the sharp corners
 25 coming into engagement with the sides of the slot at each end of the permitted 90° movement.

Preferably said part is of generally square cross-section and the fit between said parallel
 30 sides of the slot and the sides of said shank part is such that the turnpiece is releasably held in either of its two extreme positions by engagement of the flat sides of said shank part with said sides of the slot.

The turnpiece may be maintained in the slot by being sprung into the slot. Thus the other
 35 end of the turnpiece, i.e. the end remote from the head, may be of such size as to deform the portion of the first member surrounding the slot as said end passes through the slot,
 40 the member springing back the slot to its original size after the end has passed through. The head of the turnpiece will be of greater dimensions than the slot so that the turnpiece will
 45 be held in the slot by virtue of the head and the enlarged other end of the turnpiece.

Alternatively, said other end of the shank may pass with clearance through the slot and the shank is provided with a shoulder which
 50 receives a clip so that the clip is on the opposite side of the first member from the head and thus prevents the turnpiece falling out of the slot.

The combination may also include a cam piece of synthetic resinous material arranged
 55 to be snapped into position in an aperture in the second member.

The cam piece may consist of a single piece of resilient synthetic resinous material which
 60 presents a flange having a hole therein which has the central portion dimensioned to give passage to said shank and a lateral portion dimensioned to give passage to said fastening projection, a slotted member projecting from
 65 the flange and providing a split bushing with

the bore of said bushing in alignment with said central portion and the slot in the slotted member in alignment with said lateral portion, a groove in the outer surface of the bushing
 70 between the flange and the end of the bushing remote therefrom, the parts of the bushing being capable of being sprung towards one another so that its end portion can be sprung through the aperture in the second member,
 75 and a cam surface on the end of said bushing remote from the flange and inclined to the longitudinal axis of the shank to engage the fastening projection after the latter has entered the slot in said member and the turnpiece
 80 has been subsequently turned. Preferably the end of the bushing has a detent adjacent to the cam surface to receive the fastening projection to releasably hold the latter at right angles to the slot in said bushing.

Alternatively, the second member may be formed with a slot and adjacent cam surface
 85 which latter can be engaged by the fastening projection after it has passed through the slot in the second member.

The invention will now be described in detail by way of example with reference to the
 90 accompanying drawings in which:—

FIGURE 1 is an exploded perspective view of a combination embodying the invention;

FIGURE 2 is a cross-section through the combination of Figure 1 in assembled condition;

FIGURE 3 is a section through the turnpiece of the combination of Figures 1 and 2 showing the relation of the turnpiece to the slot in the first member in one extreme position of the turnpiece; and

FIGURE 4 is a section similar to Figure 3 showing said relation in the other extreme position of the turnpiece.

Referring first to Figures 1 and 2, the combination includes a turnpiece indicated generally at 110 and moulded from a single piece of resilient synthetic resinous material such as that known by the Registered Trade Mark
 110 "DELRIN" 100.

The turnpiece comprises a head 11, a shank 12 and a pair of diametrically opposed fastening projections 13. The head is formed with a pair of diametrically opposed ribs 14 which
 115 provide a handle for turning the turnpiece. A thin skirt or flange 15 projects from the shank just below the ribs 14 and is provided on its undersurface with a pair of diametrically opposed lugs 16.

The portion 17 of the shank below the flange 15 has the cross-section shown in Figures 3 and 4. The cross-section is generally square and has diagonally opposed sharp corners 18 and 19 and diagonally opposed
 125 rounded corners 20 and 21. Between the corners the cross-section presents pairs of straight, parallel, sides 22 and 23 respectively.

Below the shank portion 17 is a circumferential groove 24 which surrounds a portion of
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the shank of circular cross-section and which provides a shoulder 25. The end portion 26 of the shank remote from the head 11 is of generally conical shape with a rounded end.

5 As will be described below, the turnpiece is arranged to be engaged in a slot in a first member to be connected by the turnpiece to a second member, the slot having opposed straight sides which are parallel. The slot is indicated in Figures 3 and 4 at 27 and has opposed, straight, parallel sides 28 and 29.

10 The width of the slot, i.e. the perpendicular distance between the sides 28 and 29 is slightly greater than the perpendicular distance between the opposed sides 22 or the opposed sides 23. The width of the slot is, however, less than the distance between the sharp corners 18 and 19. When the turnpiece is in the position shown in Figure 3, the turn-
 15 piece cannot be turned in an anti-clockwise direction because of the engagement of the corners 18 and 19 with the sides 28 and 29 respectively. The turnpiece can, however, be turned in a clockwise direction to move the sharp corners 18 and 19 away from the sides 28 and 29 respectively so that the turnpiece will move to the position shown in Figure 4, this movement being permitted because the rounded corners 20 and 21 will slide relative
 20 to the sides 28 and 29 respectively. When the turnpiece is in the position shown in Figure 4, further clockwise movement is prevented since the sharp corners 18 and 19 will engage the sides 29 and 28 respectively. However, anti-clockwise movement back to the position of Figure 3 is permitted by moving the corner 18 away from the side 29 to the side 28 and moving the corner 19 away from the side 28 to the side 29. The turnpiece is thus limited
 25 to a range of movement of 90° but may move longitudinally of the slot 27 which is of importance as will be described below.

30 Figures 1 and 2 show the combination of the invention applied to the mounting of a grille to a body member, e.g. the front body shell of a tractor.

35 The grille comprises a first member or grille frame 30 which is made of synthetic resinous material and a perforated sheet 31. The grille frame 30 has openings (not shown) which are covered by the perforated sheet 31. The second member or sheet of the combinations is indicated at 32 and forms part of the body shell of a tractor. It is desired to be able releasably
 40 to connect the first member 30 and the perforated sheet 31 to the second sheet or shell member 32.

45 The slot 27 is provided in the first member 30. The turnpiece has its shank mounted in the slot with the portion 17 received therein. The first member 30 is provided with a recess 33 on its one side, i.e. the front, the recess being generally co-axial with the slot and the slot opening into the recess. The recess is
 50 generally circular but is formed with two

quadrant-shaped abutments 34 at diametrically opposed positions. The abutments provide shoulders 35 and 36, the shoulders 35 extending generally perpendicular to the length of the slot 27 and the shoulders 36
 55 extending generally parallel to the length of the slot but offset on opposite sides of the centre line thereof. As will be seen from Figure 2 the lugs 16 are received in the recess 33 and can come into engagement with the shoulders 35 and 36 as will hereinafter be described. The flange or skirt 15 is of sufficient diameter to overlap the edges of the recess 33 and engage the front surface of the first member 30.

60 The second sheet 32 is provided with a larger circular aperture 37 and a smaller aperture 38. The apertures 37 and 38 receive a cam piece generally indicated at 39. For a full description of the cam piece 39 reference should be had to said complete specifications mentioned above. Briefly the cam piece comprises a flange 40 which has a central hole 41 which has the central circular portion 42 and two lateral portions, one of which is indicated at 43, the lateral portions being diametrically opposed. The central portion 42 is dimensioned to give passage to the end portion 26 of the shank and the lateral portions 43 are dimensioned to give passage to the fastening projections 13. The cam piece also comprises a slot-
 65 ted member 44 comprising two parts 45 separated by a slot which is in alignment with the portions 43, each part 45 being provided with two surfaces 46 which are separated by a part-cylindrical detent 47. The slotted member 44 comprises a split bushing, the bore of the bushing being indicated at 48 and being in alignment with the central portion 42 of the hole 41. Each part 45 is also provided with a groove 49 in its outer surface between the flange 40 and a bevelled lip 50. The flange is provided with a lug 51.

70 The cam piece 39 is snapped into position on the second member or shell 32. Thus the slotted member 44 has the parts thereof pushed together and inserted into the aperture 37. At the same time the lug 51 is positioned opposite to the aperture 38. The slotted member 44 is then pushed through the aperture 37 until the edge of the sheet 32 around the aperture 37 engages in the grooves 49. The lug 51 also enters the aperture 38 thus preventing the cam piece from turning relative to the sheet 32.

75 The operation of the fastener is as follows. The first member or grille frame 30 is assembled to the perforated sheet 31. The grille frame 30 will normally contain a number of slots such as 27 and each slot will receive a turnpiece such as 10. The shank of the turnpiece will be placed in its slot so that the projections 16 are received in the recess 33 into which the slot opens, the projections 16 being between the arcuate abutments 34. The shank
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112 of each turnpiece is furnished with a circlip 52 which is received in the groove 24 to retain the perforated sheet 31 against the grille frame 30 and also to prevent the turnpiece falling out of the slot 27 when the grille frame 30 and sheet 31 are removed from the shell or second piece 32.

Each turnpiece is pushed through its slot 27 with the fastening projections 13 in the positions shown in Figures 1 and 4 and is then turned through 90° to the position shown in Figure 3 so that the projections 13 extend perpendicular to the length of the slot 27. The turnpiece is releasably held in this position as described below due to the relative dimensions of the portion 17 of the shank and the slot 27.

The grille comprising the frame 30 and sheet 31 can now be offered up to the shell 20 and the projections 13 of each turnpiece will be properly positioned to pass through the lateral portions 43 of the slot 41 in an associated cam piece 39 on the shell 32. The turnpiece may then be turned through 90° to the position shown in Figure 3 and the fastening projections 13 will ride over the cam surfaces 46 and will be engaged in the detents 47.

In this, the locked, position of the turnpiece, the projections 16 will engage the shoulders 36 of the abutments 34. It will be noted, however, that the turnpiece will be free to slide longitudinally of the slot 27 to take up any misalignment between the grille and the cam piece in the shell 32. The prohibition on further turning of the turnpiece in a clockwise direction, in Figures 3 and 4, due to the engagement of the sharp corners 18 and 19 with the sides 29 and 28 respectively of the slot 27 is reinforced by the engagement of the projections 16 with the shoulder 36.

The turnpiece can, however, be turned in an anti-clockwise direction from the locked position shown in Figure 4 and when in its unlocked position as shown in Figure 3, the projections 16 can engage with the shoulders 35. The spacing between the shoulders 35 considered in the direction parallel to the length of the slot 27 is such as to permit some endwise float of the turnpiece in the slot 27 when the turnpiece is in its unlocked position (Figure 4) so as to assist in allowing for any misalignment between the grille and the shell.

As the fastening projections 13 ride up the cam surfaces 46, the flange 15 on the turnpiece is deformed and acts as a spring tending to urge the fastening projections 13 into the detents 47.

It will be seen that the invention provides a turnpiece for a stud-and-socket fastener which may be mounted in a first member such as a grille frame 30 and which is prevented from having more than 90° rotation due to the co-action between the portion 17 of the spindle and the slot 27, such prevention being

reinforced by the engagement of the projections 16 with the shoulders 35 and 36.

In the embodiment described, the clearance between the portion 17 of the shank and the sides 28, 29 and ends of the slot 27 is such that if it were not for the circlip 52 the turnpiece could fall out of the slot 27 when the fastening projections 13 are in the positions shown in Figure 4. This clearance is, however, such as releasably to hold the turnpiece in the positions shown in Figures 3 and 4 so far as rotation is concerned. This is because, as the turnpiece is turned between the positions shown in Figures 3 and 4, the distance between the rounded corners 20 and 21 is such that said corners force apart the sides 28 and 29 of the slot 27 when the diagonal between the corners 20 and 21 is perpendicular to the length of the slot.

In a further embodiment of the invention, not shown, the end portion 26 of the shank 12 of the turnpiece is made of greater cross-sectional size than the portion 17 and the slot 27 is so dimensioned that the end portion 26 can be pushed through the slot by deforming and widening the slot which would then spring back to its original size when the end had passed through the slot. The turnpiece would therefore be a snap fit in the slot and would thus be prevented from falling out of the slot when the fastening projections 13 are in the position shown in Figure 4.

In another modification, not shown, the cam piece can be formed integrally with the second member or shell 32, the shell being formed with a slot and adjacent cam surfaces which can be engaged by the fastening projections after the latter have passed through the slot in the second member.

The portion 17 of the turnpiece shank is preferably generally square but it may be rectangular with one pair of sides larger than the other pair of sides. In such a case the parallel sides of the slot 27 must be spaced apart by a distance greater than the maximum perpendicular distance between the sides of the slot but less than the distance between the diagonally opposed sharp corners.

WHAT WE CLAIM IS:—

1. A turnpiece made of synthetic resinous material for a stud-and-socket fastener and comprising a shank, a head at one end of the shank and a fastening projection extending outwardly from the shank adjacent the other end thereof, at least part of the shank between the head and the fastening projection having a cross-section which is generally rectangular and presenting a pair of diagonally opposed sharp corners and a pair of diagonally opposed rounded corners.

2. A turnpiece according to Claim 1 wherein the cross-sectional shape of said shank part is generally square.

3. A turnpiece according to Claim 1 or Claim 2 wherein the head includes a thin skirt or flange adapted to act as spring means when the turnpiece is in use.

5 4. A turnpiece according to Claim 3 wherein the skirt is provided with a pair of diametrically opposed lugs which project from the skirt parallel to the shank and towards the fastening projection.

10 5. A turnpiece according to any one of the preceding claims made from a single piece of synthetic resinous material.

6. The combination of a turnpiece for a stud-and-socket fastener, for holding together first and second apertured members in face-to-face relation, and a first such member, the turnpiece and the first member both being made of synthetic resinous material, the turnpiece comprising a shank, a head at one end of the shank and a fastening projection extending outwardly from the shank adjacent the other end thereof, at least part of the shank between the head and the fastening projection having a cross-section which is generally rectangular and presenting a pair of diagonally opposed sharp corners and a pair of diagonally opposed rounded corners, said first member having a slot therein with a pair of parallel, straight sides spaced apart by a distance greater than the maximum perpendicular distance between opposite sides of said shank part of generally rectangular cross-section but less than the distance between said diagonally opposed sharp corners.

7. The combination according to Claim 6 wherein said part is of generally square cross-section and the fit between said parallel sides of the slot and the sides of said shank part is such that the turnpiece is releasably held in either of its two extreme positions by engagement of the flat sides of said shank part with said sides of the slot.

8. The combination according to Claim 6 or Claim 7 wherein the turnpiece is maintained in the slot by being sprung into the slot.

9. The combination according to Claim 8 wherein the other end of the turnpiece is of such size as to deform the portion of the first member surrounding the slot as said end passes through the slot, the member springing back the slot to its original size after the end has passed through.

10. The combination according to Claim 6 or Claim 7 wherein the other end of the shank may pass with clearance through the slot and the shank is provided with a shoulder which receives a clip so that the clip is on the opposite side of the first member from the head and

thus prevents the turnpiece falling out of the slot.

11. The combination according to any of Claims 6 to 9 including a cam piece of synthetic resinous material arranged to be snapped into position in an aperture in the second member.

12. The combination according to Claim 11 wherein the cam piece consists of a single piece of resilient synthetic resinous material which presents a flange having a hole therein which has the central portion dimensioned to give passage to said shank and a lateral portion dimensioned to give passage to said fastening projection, a slotted member projecting from the flange and providing a split bushing with the bore of said bushing in alignment with said central portion and the slot in the slotted member in alignment with said lateral portion, a groove in the outer surface of the bushing between the flange and the end of the bushing remote therefrom, the parts of the bushing being capable of being sprung towards one another so that its end portion can be sprung through the aperture in the second member, and a cam surface on the end of said bushing remote from the flange and inclined to the longitudinal axis of the shank to engage the fastening projection after the latter has entered the slot in said member and the turnpiece has been subsequently turned.

13. The combination according to Claim 12 wherein the end of the bushing has a detent adjacent to the cam surface to receive the fastening projection to releasably hold the latter at right angles to the slot in said bushing.

14. The combination according to any one of Claims 6 to 10 wherein the second member is formed with a slot and adjacent cam surface which latter can be engaged by the fastening projection after it has passed through the slot in the second member.

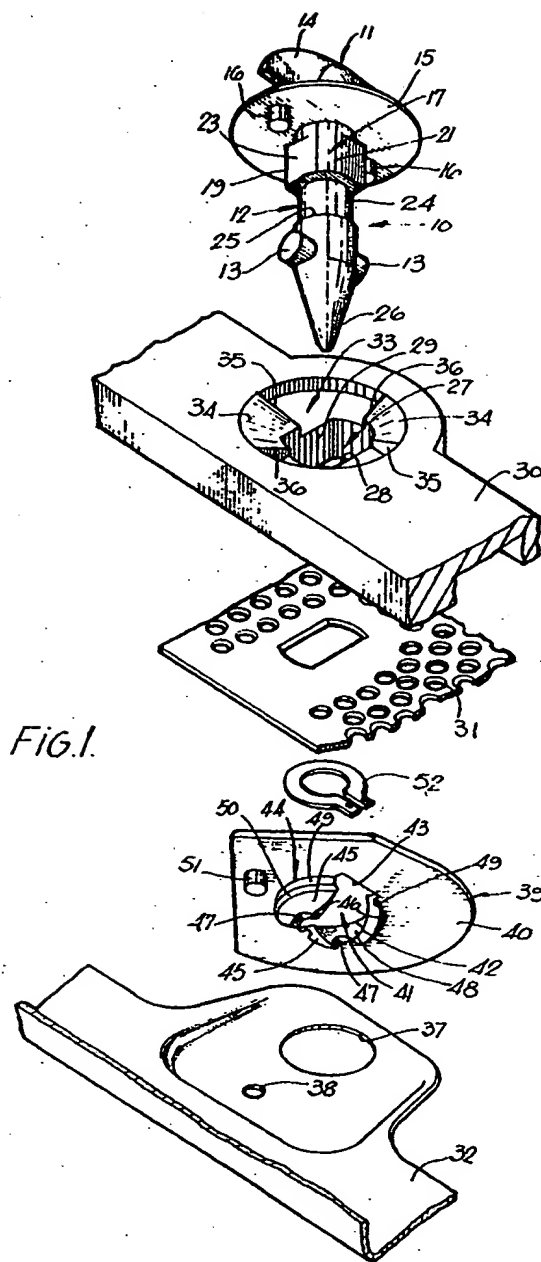
15. A turnpiece for a stud-and-socket fastener substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

16. The combination of a turnpiece according to Claim 15 with a first member to be connected by the turnpiece to a second member substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

17. The combination of a stud-and-socket fastener and first and second members substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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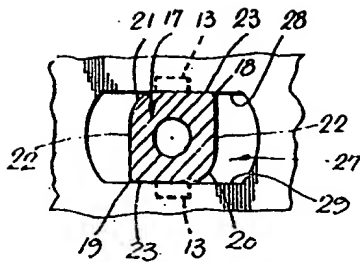


FIG. 3.

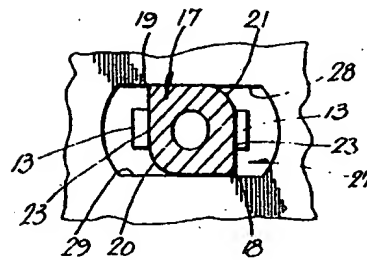


FIG. 4.

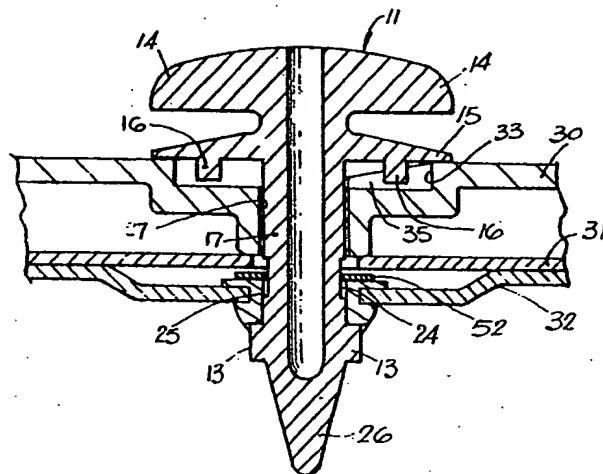


FIG. 2.

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